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SUMMER POLAR BEAR SNARING

AT WAGER BAY, N.W.T.

1978

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Wildlife Service

Northwest Territories Renewable Resources

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DON FURNELL
N.W.T. WILDLIFE SERVICE
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ABSTRACT

Foot snares were used to live-capture polar bears (Ursus maritimus) from 23 August to 13 September 1978 at Wager Bay, N.W.T. The suitability of snares for capturing polar bears was tested and found acceptable if used with transportation which permits large numbers of sets to be made and checked in most types of weather. Beluga whale blubber was the best bait for snares, with seal meat and blubber also yielding good results. Ketamine hydrochloride and xylazine used in a 7:3 mixture was a satisfactory substitute for Sernylan in bear immobilization. Higher concentrations of the standard 100 mg per ml mixture are necessary to handle large bears efficiently. The histological stain, malachite green, was sucessfully used to temporarily mark polar bear fur. The summer polar bear population of Wager Bay was subjectively estimated at 130 individuals with recruitment levels at least equal to other arctic regions.

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INTRODUCTION

Foot Snaring

In most polar bear live capture studies, helicopters have been used for drug administration (Schweinsburg et al. in press, Stirling et al. 1977b). Safe efficient helicopter use generally restricts field operations to sea ice in early spring before open water appears. Summer brings the dangers of drugged bears drowning or falling from coastal cliffs as well as risk to crews flying over open water and precipitous terrain.

A more satisfactory method was required to safely capture polar bears in summer. Foot snares seemed suitable if bears could be readily caught. The technique permits a choice of terrain and allows careful drug administration without extended chases.

Foot snares have been used to capture polar bears in three other areas. They are used extensively near Churchill, Manitoba, both for handling problem bears and for polar bear research (Jonkel 1967, Stirling et al. 1977a). Knudsen (1973) used foot snares on North Twin Island with moderate success and the Canadian Wildlife Service has conducted several snaring programs. Overland vehicles and traplines were operated in the Cape Henrietta Maria area in late September 1967; on the east coast of North Twin Island from 12-25 July 1968, almost continuously from 15 July - 24 October 1970, and from 15 September - 14 October 1972; and on the west coast of South Twin Island from 26 July - 18 August 1970; and a tagging and survey trip to the Belcher,

Sleeper, King George, and Ottawa Islands was made by canoe and longliner from 6 May - 22 September 1971 (Jonkel et al. 1976). A program on Akpatok Island by C.W.S. was unsuccessful primarily because of lack of suitable transportation (H. Kiliaan pers. comm.).

The first objective of our program was to examine the feasibility of using foot snares to capture live polar bears during summer.

Drugs

The majority of polar bear captures to date have used the immobilizing agent Sernylan (phencyclidine hydrochloride) supplemented with the anesthetic and analgesic Sparine (promazine hydrochloride). Although Sernylan is satisfactory when used in spring at low temperatures, it occasionally induces convulsions and respiratory or cardiac arrest. In summer such problems are compounded by heat stress suffered by bears. In addition, because bears seem able to tolerate greater amounts of drugs in summer, dosages are difficult to estimate. Conservative doses often result in prolonged chases causing bears to become overheated and exhausted.

A second difficulty with Sernylan is that because of its growing street abuse, acquisition is restricted.

Therefore the immobilizing agents Ketaset (ketamine hydrochloride) and Rhompun (xylazine) were selected for use on snared bears. Neither drug has been extensively tested on species of Ursus (Hebert and McFetridge 1977, Perry 1977, N. Oritsland pers. comm.). Our second objective was to test these drugs as immobilizing agents for polar bears and to safely observe the bears' responses.

Dyes

Dyes were to be used by the Northwest Territories Wildlife Service for future polar bear mark-resighting programs. Our third objective was to test the fastness of the proposed dyes by applying them to snared bears for subsequent observation.

Population Estimate

In 1978 Donaldson et al. (in press) estimated the polar bear population of the study area. Our final objective was to subjectively confirm their findings.

The Study Site

In a preliminary flight we confirmed a report by Donaldson et al. (in press) that the south shore of Wager Bay, Northwest Territories was a polar bear summer retreat. We selected that area (65° 26' N, 88° 40' W; Fig. 1) as the study site. Wager Bay extends 200 km inland from its mouth in Roes Welcome Sound on the extreme northwest corner of Hudson Bay. The south shore is characterized by steep cliffs rising almost directly from the water to elevations of 500 m. In some areas the cliffs are skirted by a narrow coastal plain or beach ranging in breadth from several meters to 0.5 km. At frequent intervals, the cliffs are cut into deep ravines by small streams and waterfalls. Several small islands, with a maximum elevation of 30 m, occur along the coast.

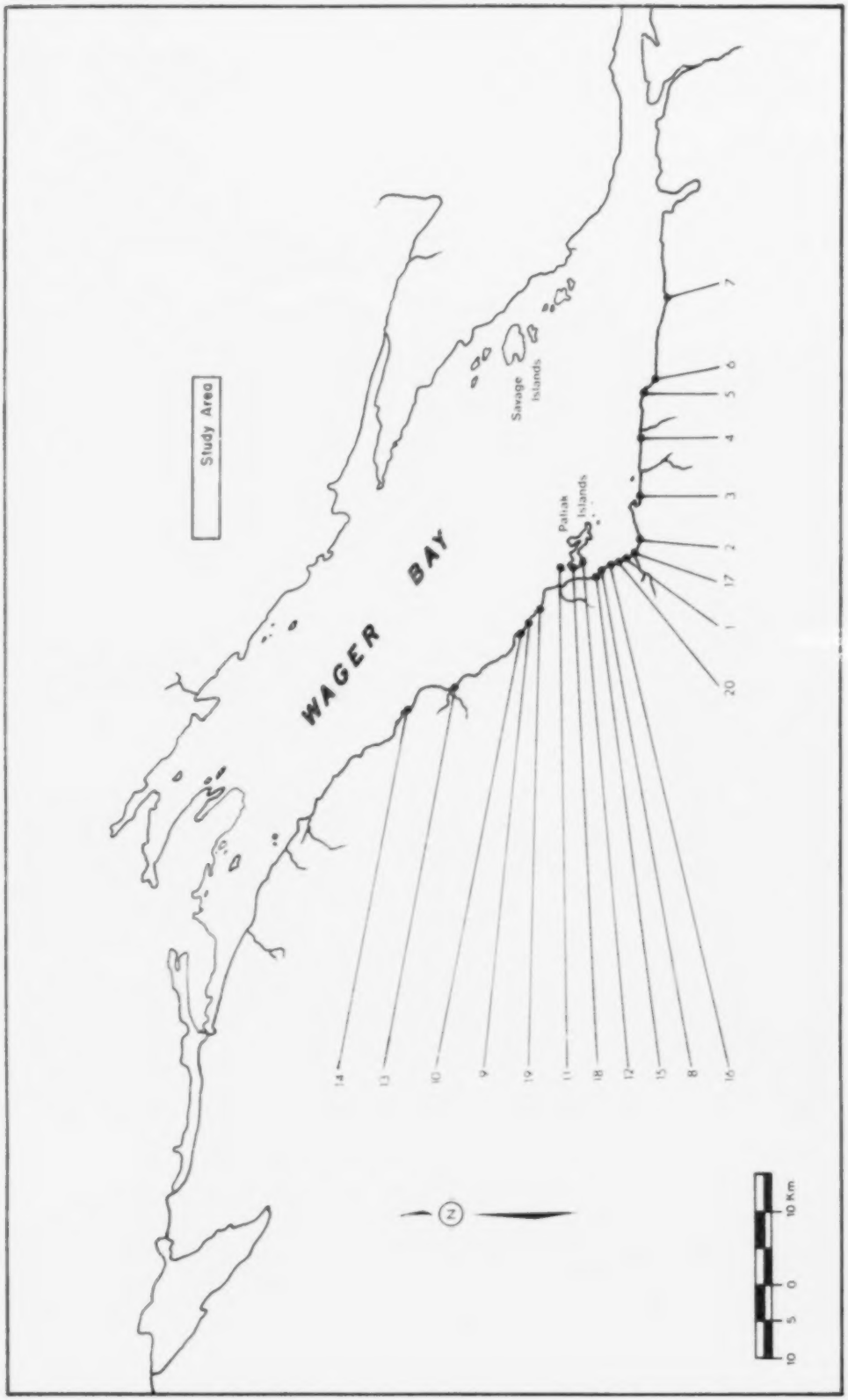

Figure 1. Study area showing the locations of snare sets along the south and west coast of Wager Bay.

The topography generally confined bear movement to the coastal plain and provided a narrow band of prime snaring territory readily accessible by water.

Tides in the bay were of the semi-diurnal type with two unequal oscillations. Spring tides approached 5 m and produced a noticeable current along the length of the bay. There was roughly an hour's delay between peak tide at the mouth and head of the bay. At two locations along the south side of the bay, wide tidal flats extend up to 0.5 km from the base of the cliffs.

Appendix A lists the flora and fauna observed in the area.

METHODS AND MATERIALS

Snaring Technique

Aldrich spring-activated animal snares (grizzly and polar bear size) were used in all sets. We travelled in two, 24-foot freighter canoes equipped with 20 hp outboard engines and placed sets along the shoreline never farther than 5 m beyond the highest high water mark. This would enable us to fire darts from the canoes if a bear from a family group was captured. Snares were camouflaged in various ways ranging from nothing or a scattered layer of dried algae to a complete cover of tundra vegetation.

All snares were set in cubbies of piled beach rubble and boulders. Snare cables were anchored to any large boulder from around which the cables would not slip. Cubbies were usually boxes, open on top and at one end, with sides 1 m high, 1 to 1.5 m wide at the mouth, and 1 to 1.5 m from the mouth to the back (Fig. 2). Bait was placed at the back of the cubby and covered with rocks. The distance from bait to snare varied both by intention and with terrain. Sharp stones were spread across the cubby floor in all areas except the snare loop. The loop was positioned over a pit of matching diameter and 15 to 20 cm deep. The snare trigger was set 7 to 10 cm into the pit to ensure that the snare loop would be around the bear's ankle before the spring was tripped.

Sets were made in areas of suitable terrain. The snare line extended 50 km on either side of camp and was checked daily, weather

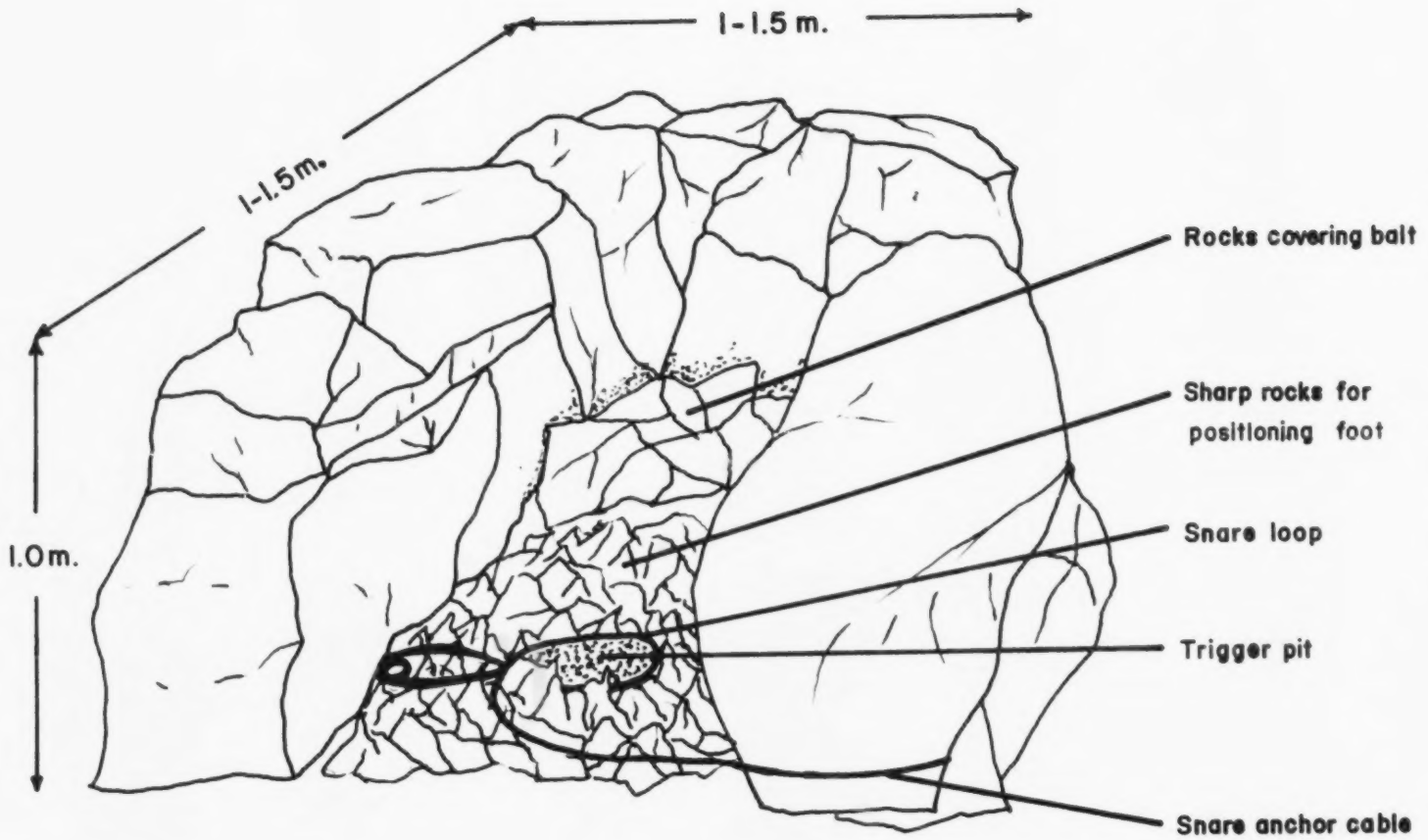

Figure 2. Typical rock snare cubby with a boulder anchoring the snare cable.

permitting. We noted any disturbance and examined tracks, remnant hair, and other signs in the area. Undisturbed sets were either left or rebaited as the situation demanded.

On early sets we used sardines (two cans) for bait. Later we used seal carcasses (provided by General Hunting Licence holders) cut into 10 kg pieces to bait several snares. Beluga whale blubber and skin were used in several sets after a whale carcass was discovered on a small island near a tidal flat. The whale bait pieces ranged from 5 to 10 kg.

Bait was rubbed across rocks in the vicinity of the cubby entrance to attract bears and induce them to enter from the front. The bait, placed at the back of the cubby, was covered with large slabs of rock to prevent bears from stealing it without fully entering the cubby.

Handling Bears

Snared bears were immobilized as soon as possible to prevent dehydration. We approached snared animals by canoe to check the security of the snare and estimate the bear's weight. We then beached the canoes a short distance away and cautiously approached the bear on foot. When the bear became accustomed to our presence, it was darted from a distance of 5 to 7 m.

The immobilized bear was then measured for total length, zoological length and axillary girth. It was tagged in each ear with a numbered delrin tag, and tattooed on both sides of the inner upper

lip with a number corresponding to the ear tag. One first pre-molar was removed for aging, the bear's sex was determined and the rump and back were painted with the test dyes. We then removed the snare and watched the bear until it had partially recovered. Later the same day we checked the bear, but did not usually reset the snare until the following day.

Drug Administration

Ketamine and xylazine solutions (100 mg per ml) were used in a 7:3 ratio (Perry 1977) both premixed and mixed on site. Initial dosages intended to approximate 2 mg per pound of bear for the combined drug (i.e. 1.4 mg Ketamine and 0.6 mg xylazine per pound) proved insufficient and were increased. Phencyclidine hydrochloride was used to immobilize one bear. Drugs were remote injected using a Cap-Chur gun (Palmer Chemicals) firing 7 or 10-cc darts carrying 4-cm unbarbed needles. Palmer green (low power) charges were used to fire the darts. Drug effect was timed and additional doses given when required, after approximately 30 minutes. Second doses depended on the bear's condition but were usually half the original.

Dye Application

The dyes tested were the biological stains alizarin red, malachite green, and toluidine blue. All were mixed in a 30% (by volume) isopropanol in water solution at concentrations approximating

5 g per litre. Dye was applied in lines with a small paint brush to the bear's rump and back and lightly worked into the fur to stain the entire length of the hairs.

Population Estimate

Because it was uncertain whether enough bears could be caught to develop a mark-recapture estimate of the population size, the estimate of population size was based on direct observation and subjective estimate. All bear sightings were recorded during trips to check the snare lines. One trip up the entire south and west shore of the bay was made to count bears and describe their distribution. Age of cubs in family groups was estimated by their size. Cubs-of-the-year could be readily identified, but yearling and 2-year old cubs could not be accurately differentiated.

General Observations

Polar bears were constantly present in the vicinity of camp, and we recorded casual observations of activity, feeding, movements, and responses to weather. Evidence of successful hunting was examined and one scat was collected - the only one solid enough to give meaningful analysis.

RESULTS

Snaring

Twenty snare sets were made at various locations along the south shore of Wager Bay (Fig. 1). Of 166 trap nights, 27 were baited with sardines, 127 with seal, and 12 with beluga. The traps were triggered six times by animals other than bears. On 30 occasions bears triggered traps, but were not caught. Of four bears captured, one was trapped twice for a total of five successes (Table 1).

Beluga whale was the most successful bait. Three of the captured bears were taken in sets baited with beluga over only 12 trap nights. Although only one bear was caught using seal, the number of tripped snares indicated it also was useful. Only one sardine baited snare was tripped and the bear was caught.

Capture success proved to be partially a function of our trapping experience (Fig. 3). As the study progressed we improved sets by widening cubby entrances (to 1.5 m), moving spring arms so they released toward the side of the cubby rather than toward the entrance, and increasing the depth of the pit beneath the snare loop.

Camouflage did not make any positive change in trapping success and seemed to interfere with the proper operation of the snare loop. The animal snares used were not equipped with swivels on the cable and consequently twisted and frayed badly when bears repeatedly rolled.

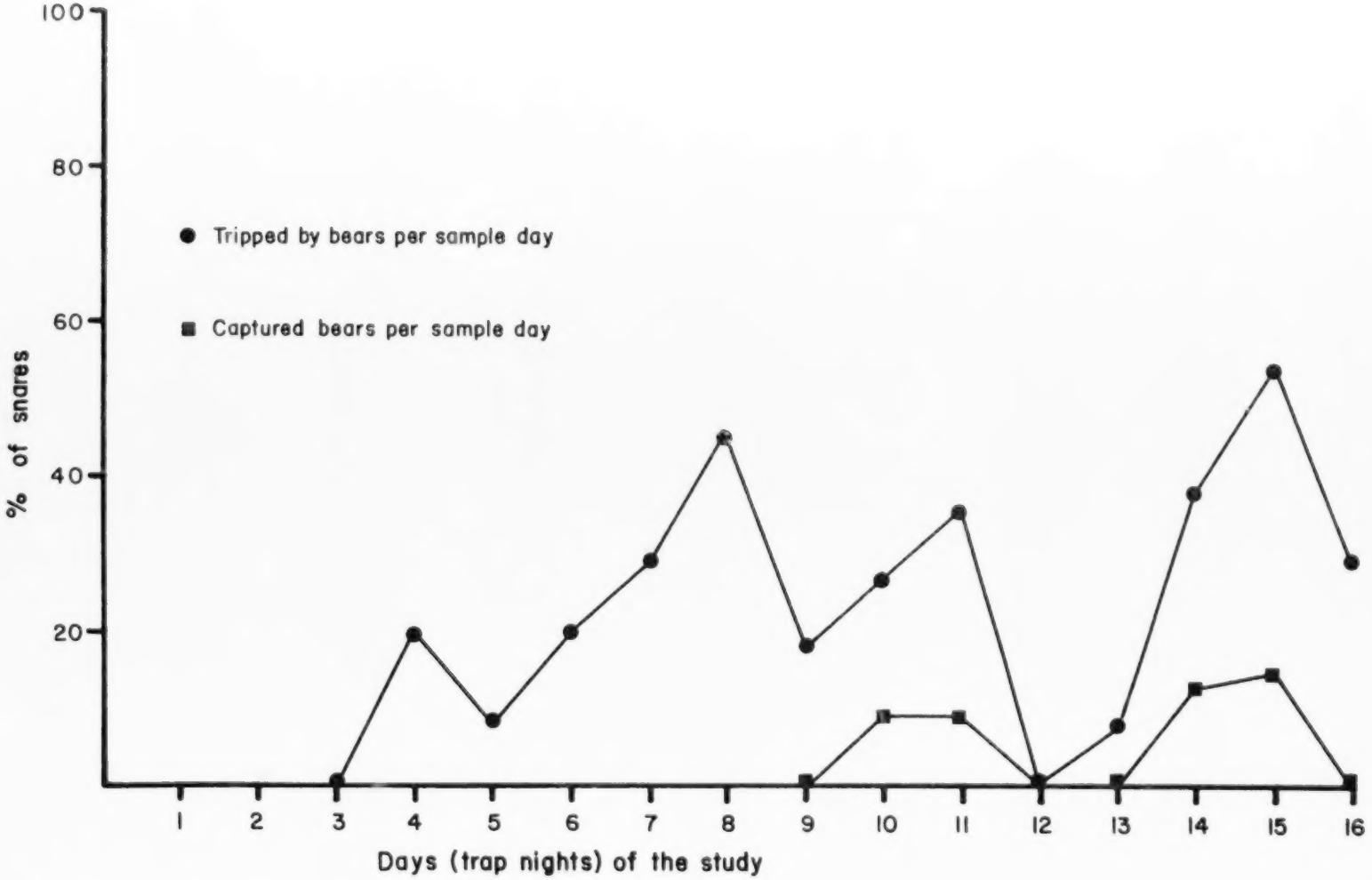

Figure 3. The percent of snares in the line which either caught bears or were tripped per sample day, Wager Bay, 1978.

Table 1. Trapping success as successes per trap night, 23 August to 13 September, 1978.

Type of success	Bait (trap night/no. of traps)			
	Sardines	Seals	Beluga	Total
Tripped by other animals	0.000	0.047	0.000	0.036
Tripped by bears (includes bears caught)	0.037	0.197	0.333	0.181
Bears caught	0.037	0.008	0.250	0.030

Drugs

Four of the five bears captured were immobilized using the Ketamine - xylazine mixture. Table 2 summarizes the drug dosages and the time over which they were administered.

The first bear drugged (X4847 original capture) was initially given 3.25 mg per lb. of the combined drug. We had intended to approximate 2 mg per lb., but over-estimated the bear's weight. The drug symptoms in the first 10 minutes were slight salivation, yawning, eyes closed, and an onset of sluggishness. These symptoms remained for 40 minutes. After 45 minutes, the bear snapped at objects placed near its head and walked awkwardly. A second dart was administered at half the initial dosage. The bear was immobile within 7 minutes. The eyes, initially protruding and twitching, remained partially closed

Table 2. Summary of drugs administered to four polar bears, Wager Bay, 1978.

Bear	Initial dosage (mg/lb)	Time to 2nd dart (min)	Second dosage (mg/lb)	Time to 3rd dart (min)	Third dosage (mg/lb)	Time to 4th dart (min)	Fourth dosage (mg/lb)	Time to immobilization from last dart (min)	Time to immobilization from 1st dart (min)	Total dosage (mg/lb)
X4847 female 05 yr. 310 lb.	3.24 (2.27: 0.97)*	47	1.63 (1.14: 0.49)	-	-	-	-	7	54	4.87 (3.41: 1.46)
X4849 female 05 yr. 397 lb.	2.50 (1.75: 0.75)	28	1.25 (0.88: 0.38)	26	1.25 (0.88: 0.38)	25	2.50 (1.75: 0.75)	10	89	7.50 (5.25: 2.25)
X4847 (recap.)	5.68 (3.98: 1.70)	-	-	-	-	-	-	5	5	5.68 (3.98: 1.70)
X4850 male 06 yr. 600 lb.	3.71 (2.41: 1.30)	-	-	-	-	-	-	2	2	3.70 (2.41: 1.30)

* (2.27: 0.97) represents dosage of Ketamine and xylazine respectively in mg/lb.

from 5 minutes after immobilization through handling. Breathing was relaxed and steady. There was no visible response to ear punching, tattooing, or tooth extraction. We removed the snare 25 minutes after immobilization. The bear recovered without warning and snapped at us. However, recovery was not complete and we held the bear's head away with a paddle as the snare was removed. The bear displayed no clumsiness when observed running and swimming 2 hours later.

The second bear handled (X4849) was initially given 2.50 mg per lb. of the drug mixture. Initial responses included slight salivation and minor protruding of the eyes. No sluggishness was apparent although yawning did occur. After 25 minutes the bear remained sufficiently active that it charged when approached. A second dart was given with half the initial dose. The bear retained motor control to the extent of walking and snapping at objects placed nearby. A third dart with half the initial dosage produced no change in behaviour. A fourth dart, administered roughly 90 minutes after the first, with an equal dosage, produced immobilization within 10 minutes. The bear's eyes protruded and twitched, but after 10 minutes closed and remained shut during handling. There was no visible response to ear punching, tattooing, or tooth extraction. Breathing remained deep and steady; the animal appeared very relaxed. The set was rechecked 2 hours later and the bear had moved 2 m. It responded to the sound of our canoe and had regained head mobility. After noting our presence, it returned to sleep. This was the most aggressive bear handled. It charged four times and almost pulled the snare cable from under a 1.5 m high anchor boulder.

The third bear handled using the experimental drugs was X4847 during a recapture. To avoid the protracted drugging sequence which occurred during its original capture, a dosage of 5.68 mg per lb. of combined drug was given in two darts fired 5 minutes apart. The tolerance of previously captured bears indicated that this dosage was not excessive. Immobilization occurred within 5 minutes. Breathing remained deep and steady through handling and the eyes remained closed. When the bear was checked 2 hours later its condition had not changed. No head mobility was apparent, but breathing remained steady. The following day when the set was checked, the bear had departed.

The fourth bear drugged with the experimental mixture (X4850) was caught less than 350 m from camp. The bear had been in the snare approximately 9 hours before drugging. From experience with the previous bears, I felt that a large initial dose was preferable to repeated conservative doses and therefore attempted to administer 4 mg of the combined drug per lb. Two darts were fired in rapid succession giving a total dosage of 3.71 mg per lb. Immobilization occurred within 2 minutes. During handling, respiration was deep and steady at seven breaths per minute. The eyes remained closed throughout handling. The bear was able to respond to sounds and had regained head mobility 4 hours after immobilization. It was gone the following morning.

A fifth bear was captured, but because of its large size, I decided to employ Phencyclidine hydrochloride for immobilization. The

bear was found dead 24 hours later, apparently due to acute digestive failure perhaps induced by the immobilizing agent. Appendix B is a report of the incident. The dyed patch on the rump was skinned out to test for dye fastness.

Dyes

We had only two opportunities to re-examine the dyes applied to polar bear hides. Bear X4847, recaptured 7 days after the dyes were applied, had almost completely lost the toluidine blue mark. The malachite green stain remained distinct and readily identifiable although the colour intensity had faded by 30-50%. Alizarin red remained fairly distinct, although faded by 60-70%.

The piece of dyed fur taken from the dead bear was towed behind our canoe for approximately 100 km, then left exposed to both sun and rain for 3 days. The resulting loss of colour was similar to that described for X4847, although fading occurred to a greater degree. This may be attributable to the slipping of hair from the hide and the action of water when the skin was towed at high speed for a long distance.

Population Estimate and Productivity

Because it was not possible to capture a large enough sample of bears to yield a mark-recapture population estimate, the following results are subjective. Over the 22-day span of the study, 114 bears

were observed. Many bears were seen more than once, but by carefully noting differences between individuals, it was possible to determine the approximate number of bears in the area (Table 3).

All sightings except two were made along or very near the shoreline (Fig. 4). During periods of calm sunny weather, the number of sightings greatly decreased. It is difficult to determine if the reduction in sightings resulted from the general inactivity of bears during warm weather or from a movement away from the coast to higher elevations and cooler temperatures. Assuming that bears were not remaining permanently away from the coast, the duration of the study was likely time enough to observe most bears in the area.

The sightings were made over approximately 100 km of the south Wager Bay coast. The entire bay has about 500 km of shoreline. The south shore extends for approximately 200 km and the north shore 300 km. Donaldson et al. (in press) found roughly twice the number of bears per km of shoreline on the south coast compared to the north. Thus, assuming equal densities of bears along the south shore, there were probably about 100 bears on the south shore during our study. Based on our estimate of the number of bears on the south shore, we expected the north shore to have approximately:

$$\frac{\frac{300 \text{ km}}{200 \text{ km}} \times 100 \text{ bears}}{2} \approx 75 \text{ bears}$$

Therefore, an estimate of the total population of polar bears in Wager Bay during our study is 175 bears. This estimate is probably inflated because most sightings were made in the area west of Paliak Islands

Table 3. Sightings and subjective estimates of the number of polar bears present, Wager Bay, 1978.

Type of sighting	Total sightings	Estimated number of duplicate sightings	Actual number of bears seen
Female with two cubs older than 1 year	7 groups	4 groups	3 groups X 3 bears = 9
Female with two cubs-of-the-year	4 groups	1 group	3 groups X 3 bears = 9
Female with one cub older than 1 year	1 group	-	1 group X 2 bears = 2
Female with one cub-of-the-year	1 group	-	1 group X 2 bears = 2
Female with three cubs-of-the-year	1 group	-	1 group X 4 bears = 4
Lone bears	73	48	73 - 48 = 25
Total	-	-	51

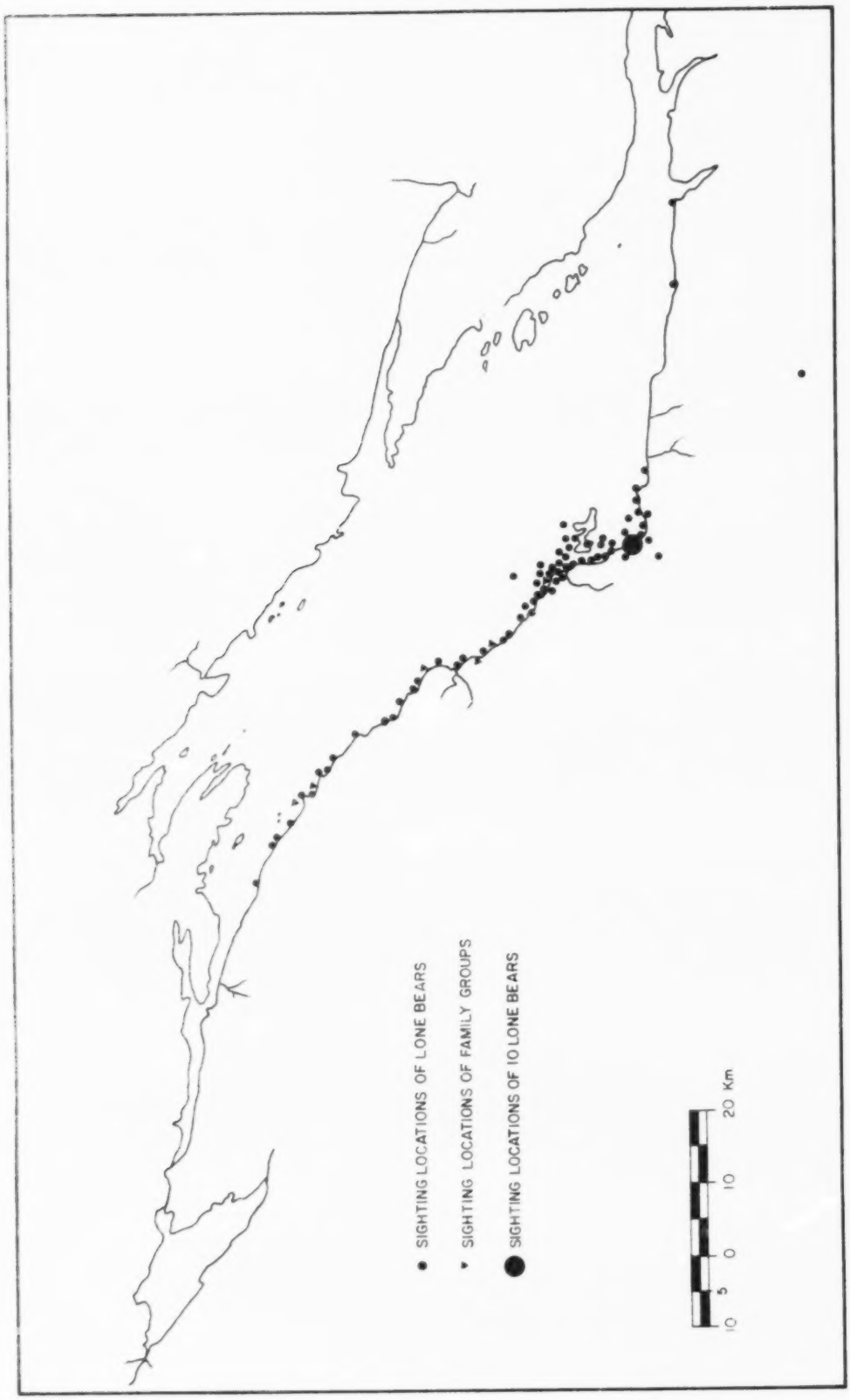

Figure 4. Locations of polar bear sightings in the study area between 23 August and 13 September 1978.

which is known to have the greatest density of bears on the south shore and because the number of duplicate observations are difficult to determine accurately over a long period of time. A subjective estimate would place the population closer to 130 bears. This estimate is twice that of Donaldson et al. (in press); however, their survey flights took place during periods of clear sunny weather when polar bear activity is minimal and counting is more difficult.

Of the 50 bears observed, 17 were cubs in family groups (34%). Assuming a 1:1 sex ratio such as normally occurs in polar bear populations (Schweinsburg et al. (in press) the mean litter size of cubs-of-the-year was 2.0 ($\pm$ S.E. = 0.71) and of cubs older than 1 year was 1.75 ($\pm$ S.E. = 0.50). These values are higher than those normally found among polar bears (Stirling et al. 1977b) and may be biased by our relatively low sample sizes.

Casual Observations

Because bears were constantly in the vicinity of camp, it was possible to observe their behaviour. During periods of warm sunny weather the bears restricted their activity to crepuscular and nocturnal patterns. As clouds, rain, and cold weather set in, bears became active throughout the day and the number of bears invading camp increased dramatically.

Perhaps the most interesting observation was of a polar bear catching a free swimming ringed seal (Furnell and Oolooyuk 1980). Seven freshly killed seals were located on the beaches of the study area indicating a fair degree of polar bear hunting success.

The single scat collected contained 30% crowberry (Empetrum nigrum), 5% crowberry leaves, 15% blueberry (Vaccinium uliginosum) and 50% polar bear hair. The amount of hair might suggest cannibalism, although polar bears do groom themselves.

DISCUSSION

Foot Snaring

The greatest impediment to successful snaring was a lack of suitable transportation. In rough water our canoes permitted setting snares only over a short length of shoreline. Snares had to be set not more than 5 m from the high water mark in order to dart free roaming members of family groups. Thus we were limited in the number of snares which could be set and routinely checked.

Our trapping success (Table 1) indicates that a snare line set by experienced researchers, using beluga for bait and containing 50 sets, should capture 12 to 13 bears per night. It is likely that our success with beluga is somewhat exaggerated compared to other baits; however, if success is reduced to half its recorded value, a 50-set snare line would probably capture six to seven bears per night. Maintenance of 50 snares would require a helicopter, but the flying would be easier and safer than that required to capture free roaming bears. A helicopter would enable crews to set snares farther inland, would greatly increase the available trapping area and would allow an aerial survey to be conducted simultaneously. The greatest problem in helicopter use would be making the large number of cubbies required. However, this could be partly compensated for by slinging 45-gallon drums to the sites and filling them with sand and rocks. With sets placed a maximum of 5 to 10 km apart, 50 snares could easily be checked in half a day, allowing the remainder of the day for handling

captured bears. Furthermore, cubbies could be left and used in future work.

It is therefore concluded that foot snaring, if used with suitable transportation, is a feasible means of capturing bears during summer. It eliminates the problems associated with helicopter use on free-ranging bears by allowing for choice of terrain and conservative drug administration without fear of the bears' escaping or creating dangerous situations.

Drugs

The Ketamine-xylazine drug mixture tested was adequate for immobilizing polar bears and in terms of the bears' well-being was superior to Sernylan (phencyclidine hydrochloride). The major disadvantages are the sudden recovery of immobilized animals without warning and the large volumes required for immobilization. The recovery problems appear to be associated with low dosages and could likely be overcome with experience; however, higher concentrations must be available if the drugs are used for handling large bears. Freeze-drying and reconstitution at higher concentrations is an alternative if higher concentrations cannot be commercially acquired. A good working dosage in summer would approximate 4.5 to 5.0 mg of combined drug per lb. of bear. A suitable concentration would then be 500 mg of the combined drug per cc of solution.

The tolerance of polar bears to the mixture appears wide and even at the greatest dosage administered (5.68 mg per lb.) no visible

distress was noted. The experimental mixture did not induce respiratory arrest or convulsions as Sernylan does and it functions well as an analgesic.

Dyes

Malachite green was the most successful dye tested and should be adequate for subsequent polar bear censuses. Alizarin red, although marginally satisfactory, is not as useful because of the difficulty in distinguishing it from blood stains frequently found on polar bears. Toluidine blue did not remain on the fur and is of no use in staining bears.

Population Estimate

Our population estimate is more than twice that of Donaldson et al. (in press). The subjective nature of the estimate leaves it open to question. To accurately enumerate bears in the area, a mark-recapture estimate using snares and a helicopter should be combined with routine aerial surveys. The number of sightings we recorded indicate that the estimate of Donaldson et al. (in press) is low, but neither can the accuracy of our study's estimate be deemed acceptable.

Productivity appears at least equal to that of polar bears in the Central Arctic (Schweinsburg et al.in press) as indicated by the similar percent of females accompanied by cubs and the higher mean

litter sizes. Wager Bay is known to be a polar bear denning area (K. Davidge, pers. comm.) and the high productivity values may simply indicate that females with young remain in the area after parturition. To determine the actual productivity of polar bears in Wager Bay, information must be gathered from the entire population of which they are a part. Our estimates of productivity are also biased by our inability to distinguish between adult and subadult females.

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PERSONAL COMMUNICATIONS

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APPENDIX A. Flora and Fauna Observed in the Wager Bay area N.W.T., 23 August to 13 September 1978.

BIRDS

Arctic Loon	(Gavia arctica)
Peregrine Falcon	(Falco peregrinus)
Black Guillemot	(Cepphus grylle)
Lapland Longspur	(Calcarius lapponicus)
Common Raven	(Corvus corax)
Canada Goose	(Branta canadensis)
Snow Goose	(Chen caerulescens) blue phase
Willow Ptarmigan	(Lagopus lagopus)
Herring Gull	(Larus argentatus)
Long-Tailed Jaeger	(Stercorarius longicaudus)
Snow Bunting	(Plectrophenax nivalis)

MAMMALS

Arctic Hare	(Lepus arcticus)
Arctic Ground Squirrel	(Spermophilus parryii)
Barren-Ground Caribou	(Rangifer tarandus groenlandicus)
Beluga Whale	(Delphinapterus leucas)
Ringed Seal	(Phoca hispida)
Bearded Seal	(Erignathus barbatus)
Wolf	(Canis lupus)
Arctic Fox	(Alopex lagopus)
Polar Bear	(Ursus maritimus)

PLANTS

Bearberry	(Arctostaphylos alpina)
Blueberry	(Vaccinium uliginosum)
Crowberry	(Empetrum nigrum)
Lingonberry	(Vaccinium vitis-idaea)
Labrador Tea	(Ledum palustre)
Woodsia spp.	
Lapland Cassiope	(Cassiope tetragona)
Mountain Sorrel	(Oxyria digyna)
Arctic Willow	(Salix arctica)
Willow	(Salix glauca)
Cotton Grass	(Eriophorum spp.)
Sedges	(Cyperaceae)
Moss Campion	(Silene acaulis)
Saxifraga spp.	

APPENDIX B. Report of a Polar Bear Handling Death at Wager Bay, Keewatin Region.

During tagging operations at Wager Bay, a large adult male polar bear died through what we believed to be acute digestive failure, possibly induced by administration of the immobilizing agent Sernylan (Phencyclidine hydrochloride).

Circumstances leading to the incident began 2 September 1978 when David Oolooyuk and Norman Barichello discovered the carcass of a small beluga whale on the shore of an island immediately north of the Paliak Islands. The carcass was later cut up and cached under rocks with intentions of testing the stored meat for baiting snares. On the same island, approximately 500 m from the cache, a snare had been set on 27 August.

On 3 September the snare (Set XI) was checked and found untouched. A lone bear was seen in the vicinity of the beluga cache and closer examination showed that it had partially uncovered the meat and eaten a small amount. The snare was rebaited with beluga and the cache reburied.

At 1030 hours on 4 September the snare was checked and found to hold a 270 kg (600 lb.) adult male polar bear. The bear had apparently broken into the cached beluga and eaten much of it. The bear was lethargic, rolling over on its back and paying us little attention. Its abdomen was extremely enlarged as a result of its recent meal.

It was our practice to immediately immobilize, tag, and release any bears found snared in case weather prevented us from returning to the snare at a later date. It was thought that this would avoid dessication problems bears might experience if left for long periods without access to fresh water.

We decided to use Sernylan to immobilize this individual instead of the experimental drugs ketamine and Rhompun. The decision was based on the bear's large size, the fact that we had only 3,000 mg of ketamine with us and the desire not to mix Sernylan and ketamine should the 3,000 mg prove insufficient. Our previous experience with ketamine had shown that the recommended dosages were far too low and we were, therefore, uncertain as to the amount necessary to immobilize a large bear.

At 1032 the bear was injected with 800 mg of Sernylan and 100 mg of Sparine from a dart administered to the left thigh from a distance of approximately 6 m. By 1050 hours, the bear was immobile. We waited half an hour to ensure that no respiratory arrest problems would occur and then handled the bear in the normal manner. It appeared to have taken the drug well and displayed no abnormal reaction or stress. At 1117 hours the respiratory rate was recorded at a steady 12 per minute. The bear was subsequently watched until 1200 hours at which time it had recovered full head mobility and partial function of the forelegs. At 1320 hours, the bear was rechecked on our return from the snare line. It was lying down, rubbing its head on the gravel presumably to wipe the tattoo dye from its mouth. It appeared well on its way to complete recovery.

At 1030 hours on the following day Norman Barichello and I rechecked the set and found the bear dead. It had moved slightly from the original tagging position. The body was grossly bloated, the anus distended 7 cm from the body, and oil and blood were dripping from the nose, mouth and anus. It appeared to have been unable to properly digest the great amounts of blubber it had eaten and died possibly from the resulting bloating or the heat. The hair was slipping badly on the hide so I decided to skin out only the dyed patch on the rump to test the dye's fastness. When my knife broke the skin, oil bubbled from the knife hole and I was engulfed in a fetid cloud of steam.

The snare set was removed from the island and the carcass left to be consumed by other bears, foxes, and gulls. We intended to sink it in the bay at the end of the expedition but scavengers prevented the need for this.